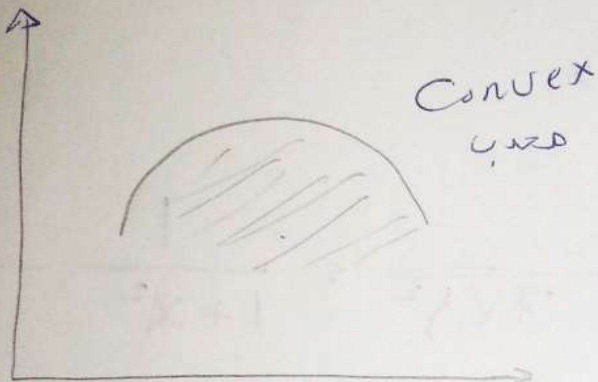
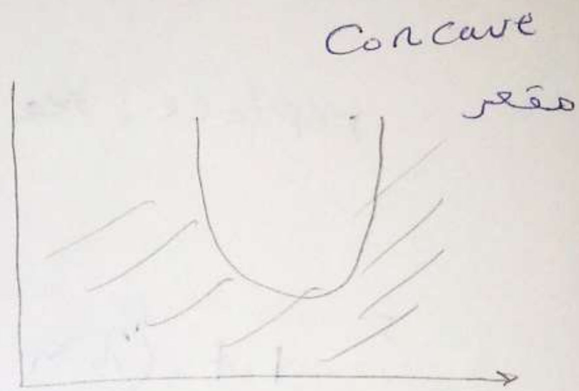
Math3b   سكشن 5   Fuzzy

← توجد مراجعة على السكشن السابق لكن لم ألحقها . ☹
sec 3

"Convex Fuzzy set"





← لو أخذت أى نقطتين على الدالة ووصلت بينهم بخط يكون داخل الدالة.

$$\boxed{\mu(\lambda x_1 + (1-\lambda)x_2) \geqslant \min(\mu x_1, \mu x_2)}$$

$\boxed{Ex : 1}$ $\mu = \dfrac{1}{1+x^2}$

اى

Let $\mu x_1 < \mu x_2$

$$R.H.S = \min(\mu x_1, \mu x_2) = \mu x_1 = \frac{1}{1-x_1^2} \rightarrow (1)$$

$L.H.S = \mu(\lambda x_1 + (1-\lambda)x_2)$

$$= \frac{1}{1+(\lambda x_1 + (1-\lambda)x_2)^2}$$

replace ~~x~~ $x_2 \longrightarrow x_1$

$$= \frac{1}{1+(\lambda x_1 + x_1 - \lambda x_1)^2} = \frac{1}{1+x_1^2} \longrightarrow 2$$

$L.H.S = R.H.S \Rightarrow$ Convex #

$\boxed{ex2}$ $\mu = \begin{cases} 0 & x \leq 10 \\ \dfrac{1}{1+(x-10)^{-2}} & x > 10 \end{cases}$

Sol

at $\mu = 0$

$\mu_{x_1} < \mu_{x_2}$

$R.H.S = \min(\mu x_1, \mu y_2) = \mu_{x_1} = 0$

$L.H.S = \mu(\lambda x_1 + (1-\lambda)x_2) = 0 \longrightarrow$ Convex

for $\longrightarrow \mu = \dfrac{1}{1+(x-10)^{-2}}$

$\mu_{x_1} < \mu_{x_2}$

$R.H.S = \min(\mu_{x_1}, \mu_{x_2}) = \mu_{x_1} = \dfrac{1}{1+(x_1-10)^{-2}}$

$L.H.S = \mu(\lambda x_1 + (1-\lambda)x_2)$

$= \dfrac{1}{1+(\lambda x_1 + (1-\lambda)x_2 - 10)^{-2}}$ إستبدال $x_2 \longrightarrow x_1$

$= \dfrac{1}{1+(x_1-10)^{-2}} = R.H.S \Rightarrow$ Convex

"Magnitude of fuzzy set"

* Scaler Cardinality $= |\tilde{A}| = \sum \mu$

* relative Cardinality $= \|\tilde{A}\| = \dfrac{\sum \mu}{X}$

(a) $A = \{(x, 0.4), y(0.5), (z, 0.9), (w, 1)\}$

(b) $\tilde{B} = \{\frac{0.5}{u}, \frac{0.8}{v} + \frac{0.9}{w} + \frac{0.1}{x}\}$

(c) $\mu = (\frac{x}{x+1})^2, \quad X = \{0, 1, 2, 3, \cdots, 10\}$

Solution

a)

$|\tilde{A}| = \sum \mu = 0.4 + 0.5 + 0.9 + 1 = 2.8$

$||\tilde{A}|| = \frac{2.8}{4} = 0.7$

b)

$|\tilde{B}| = \sum \mu = 0.5 + 0.8 + 0.9 + 0.1$

$||\tilde{B}|| = \frac{\sum \mu}{4} =$

c)

$\tilde{C} = \{\frac{0}{0} + \frac{0.25}{1} + \frac{0.44}{2} + \frac{0.56}{3} + \frac{0.64}{4}$

$+ \frac{0.7}{5} + \frac{0.73}{6} + \frac{0.77}{7} + \frac{0.8}{8} + \frac{0.81}{9} + \frac{0.83}{10}\}$

$|\tilde{C}| = \sum \mu = 6.53$

$||\tilde{C}|| = \frac{\sum \mu}{|X|} = 0.56$

$\boxed{4}$ sec5

"operations on fuzzy set"

$\boxed{1}$ Complement $\mu_{\bar{\tilde{A}}} = 1 - \mu_{\tilde{A}}$

$\boxed{2}$ union $\mu_{\tilde{A} \cup \tilde{B}} = \max(\mu_A, \mu_B)$

$\boxed{3}$ intersection $\mu_{\tilde{A} \cap \tilde{B}} = \min(\mu_A, \mu_B)$

$\boxed{4}$ $\tilde{A} - \tilde{B} = A \cap B^c$

$\tilde{B} - \tilde{A} = \tilde{B} - A^c$

← التعريفات دي وضعها لطفي زاده
لكن فيه تعريفات بشكل آخر للخمس نقط
دي لكننا بندرس دي عشان خاطر
مصر -

$\boxed{5}$ $A \nabla B = (A-B) \cup (B-A)$

$\boxed{ex}$ $\tilde{A} = \frac{0.2}{1} + \frac{0.3}{2} + \frac{0.\cancel{8}5}{3} + \frac{0.9}{4}$

$\tilde{B} = \frac{0.4}{1} + \frac{0.2}{2} + \frac{0.6}{3} + \frac{0.8}{4}$

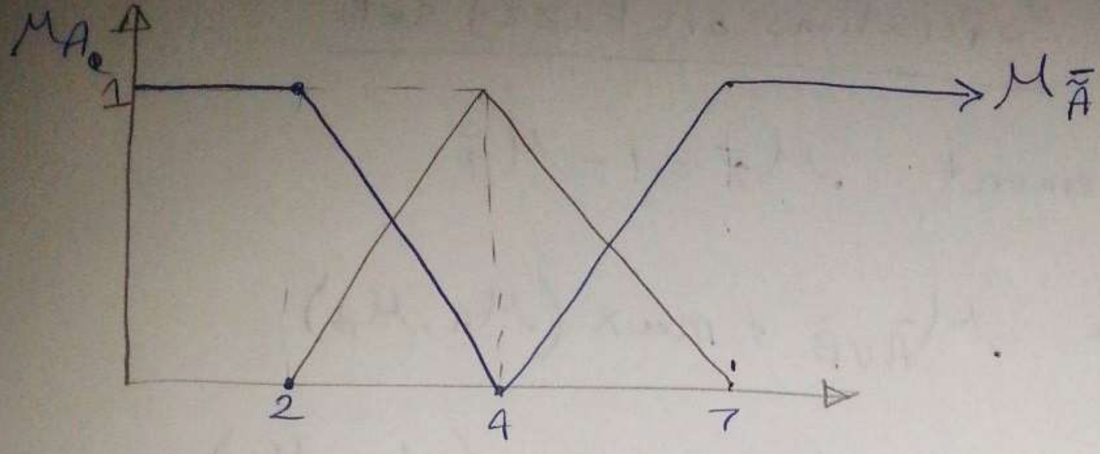
sol

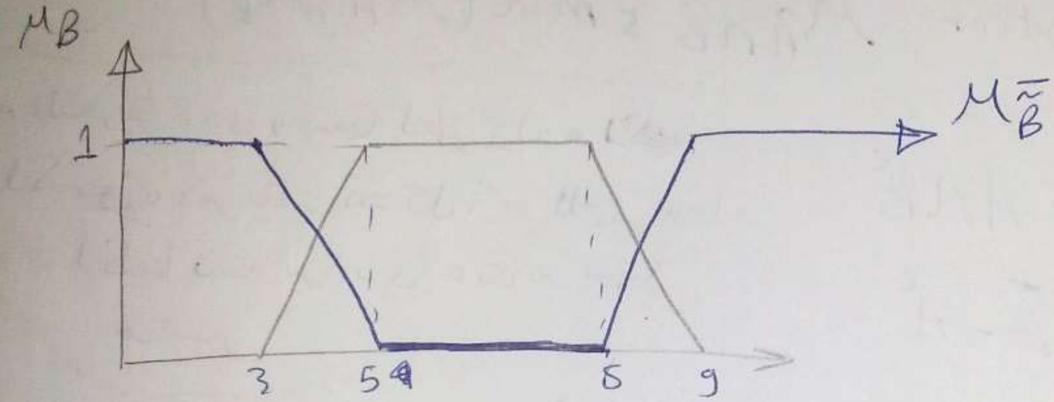
$\bar{\tilde{A}} = \frac{0.8}{1} + \frac{0.7}{2} + \frac{0.\cancel{8}5}{3} + \frac{0.1}{4}$

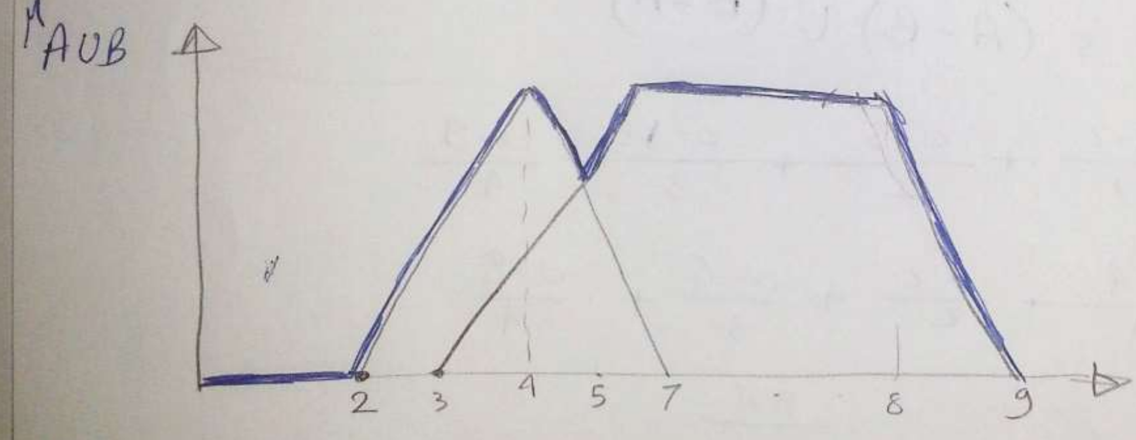
$\tilde{A} \cup \tilde{B} = \frac{0.4}{1} + \frac{0.3}{2} + \frac{0.6}{3} + \frac{0.9}{4}$

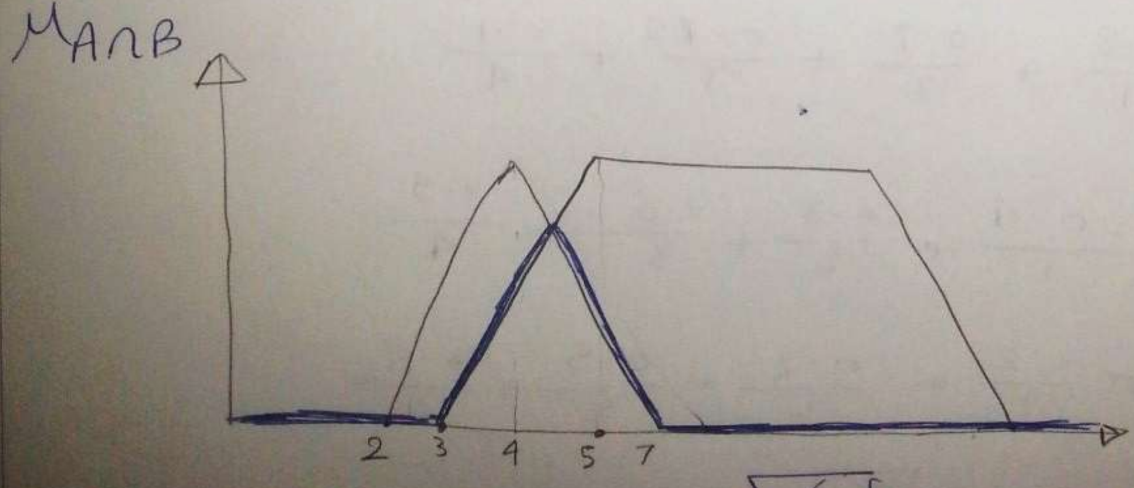
$\tilde{A} \cap \tilde{B} = \frac{0.2}{1} + \frac{0.2}{2} + \frac{0.5}{3} + \frac{0.8}{4}$

$\boxed{5}$ sec 5


μ_A
1
$\mu_{\bar{A}}$
2
4
7


μ_B
1
$\mu_{\bar{B}}$
3
5
8
9


$\mu_{A \cup B}$
2
3
4
5
7
8
9


$\mu_{A \cap B}$
2
3
4
5
7

" مسائل من امتحانات سابقة "

* Consider the fuzzy set F & G defined in interval [0, 10] by the membership

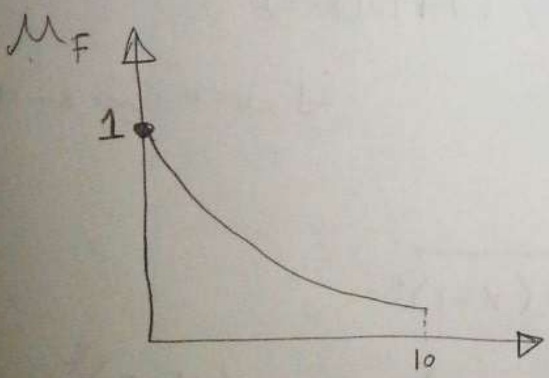
$\mu_F = 2^{-x}$, $\mu_G = \dfrac{1}{1-10(x-2)^2}$, Determine the mathematical formula and graphs of membership functions of

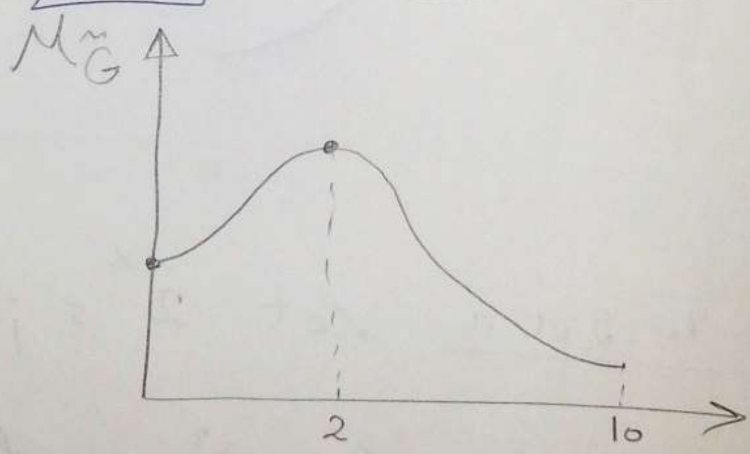
i) $\mu_{\bar{F}}$ & $\mu_{\bar{G}}$

ii) $\mu_{F \cup G}$ & $\mu_{F \cap G}$

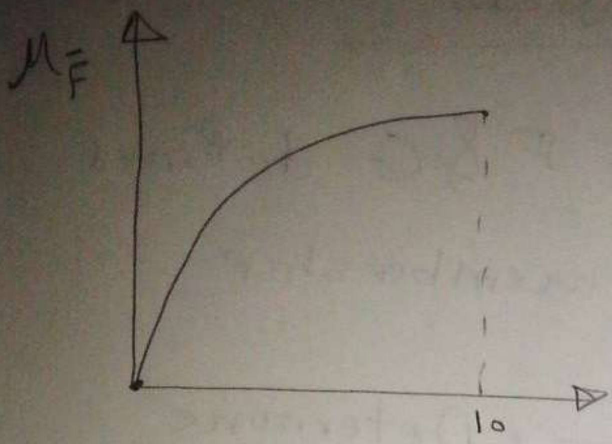
من امتحان العام الماضي

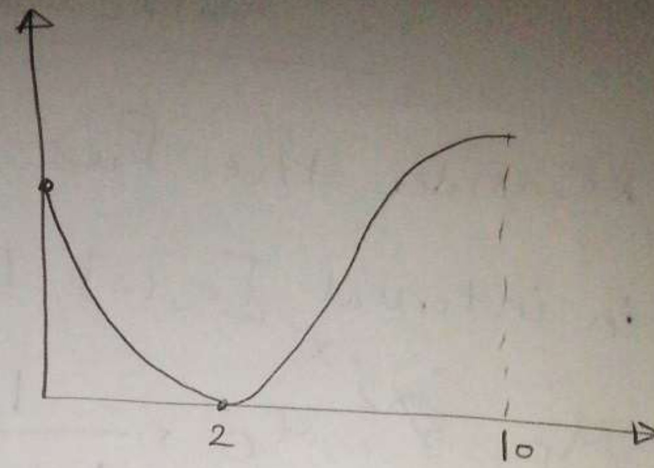
$\boxed{\text{Sol}}$





← احنا بنرسمهم في البداية.



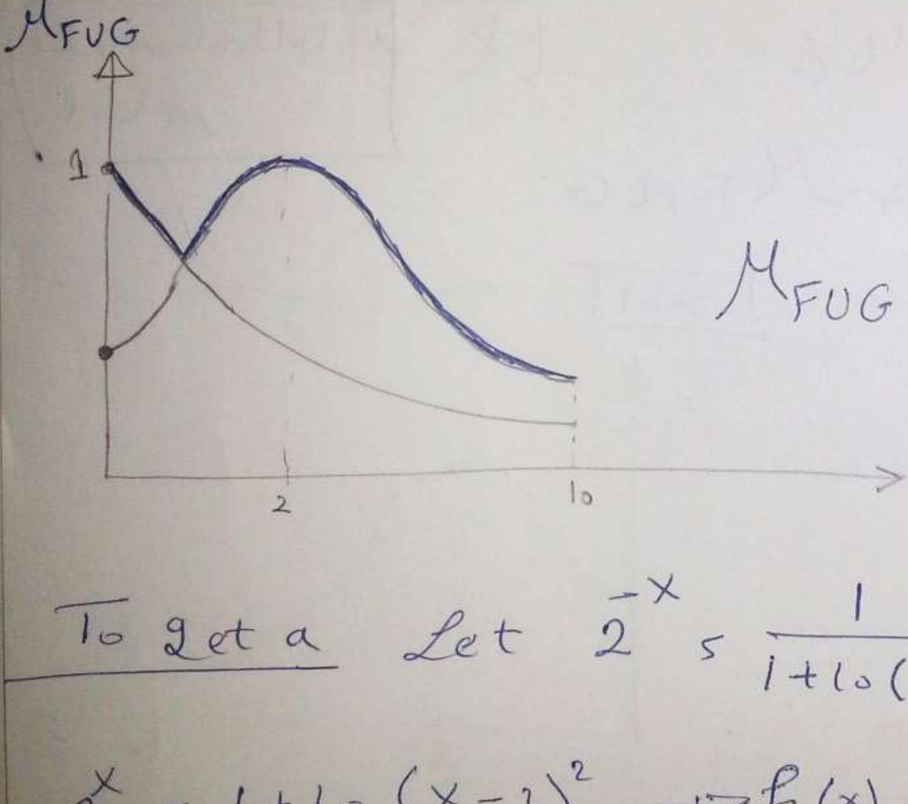


$\mu_{\bar F} = 1 - \mu_F$

$= 1 - 2^{-x}$

$\mu_{\bar G} = 1 - \mu_G$

$= 1 - \dfrac{1}{1+10(x-2)^2}$



$$\mu_{FUG} = \begin{cases} 2^{-x} & 0 \leq x \leq a \\ \dfrac{1}{1+10(x-2)^2} & a \leq x \leq 10 \end{cases}$$

a ← قيمة مجهولة

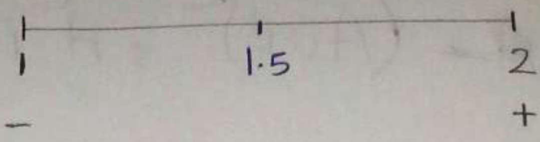
<u>To get a</u> Let $2^{-x} = \dfrac{1}{1+10(x-2)^2}$

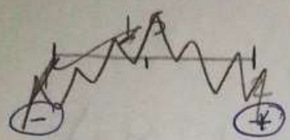
$2^{x} = 1 + 10(x-2)^2 \Longrightarrow f(x) = 2^{x} - 1 - 10(x-2)^2$

← هنعوض عن x بقيم ولو الإشارة تغيرت هنعمل فترة ونقسمها .....

$f(1) = -9$ ⊖

$f(2) = 3$ ⊕





$f(1.5) = -ve$

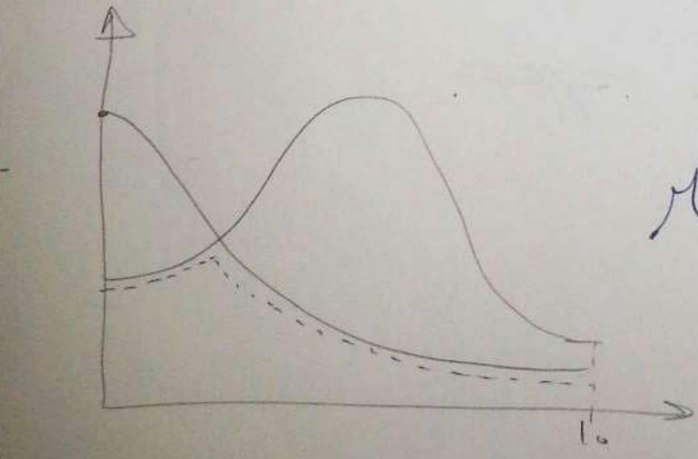
← نقسم الفترة ما بين 1.5 ، 2

$f(1.75) = +ve$

← إذا ناخذ قيمة تقريبية ما بين 1.5 ، 1.75 فتكون 1.65

$$\mu_{F \cup G} = \begin{cases} 2^{x} & 0 \leq x \leq 1.65 \\ \dfrac{1}{1+10(x-2)^2} & 1.65 \leq x \leq 10 \end{cases}$$

$\mu_{F \cap G}$



$$\mu_{F \cap G} = \begin{cases} \dfrac{1}{1+10(x-2)^2} & 0 \leq x \leq 1.65 \\ 2^{-x} & 1.65 \leq x \leq 10 \end{cases}$$

* Show Demorgan's law using fuzzy set

$\boxed{1}$ ~~A~~ $(A \cup B)^c = A^c \cap B^c$ ⟶ complement

Sol

$1 - \max(\mu_A, \mu_B) = \min(1-\mu_A, 1-\mu_B)$

⟵ هذا المطلوب إثباته

Let $\mu_A < \mu_B$

L.H.S $= 1 - \max(\mu_A, \mu_B) = 1 - \mu_B$

R.H.S $= \min(1-\mu_A, 1-\mu_B)$

$-\mu_A > -\mu_B \Rightarrow 1-\mu_A > 1-\mu_B$

R.H.S $= 1 - \mu_B$ #

$\boxed{2}$ $(A \cap B)^c = A^c \cup B^c$

$$1-\min(\mu_A, \mu_B) = \max(1-\mu_A, 1-\mu_B)$$

<u>Let</u> $\mu_A < \mu_B$

L.H.S $= 1-\min(\mu_A, \mu_B) = 1-\mu_A$

R.H.S $= \max(1-\mu_A, 1-\mu_B)$

$-\mu_A > \cancel{1}-\mu_B \Rightarrow 1-\mu_A > 1-\mu_B$

R.H.S $= 1-\mu_A$

R.H.S $=$ L.H.S //

← مهم السكاشن جداً و هيجي كتير
منه في الإمتحان